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APPLICATION

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TITLE: RETAINING HEAT SINKS ON PRINTED CIRCUIT BOARDS

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RETAINING HEAT SINKS ON PRINTED CIRCUIT BOARDS

Background

This invention relates generally to securing heat sinks over electronic devices to be cooled on printed circuit boards.

Printed circuit boards, such as motherboards, may include a number of electronic components. These electric components may produce heat which needs to be dissipated through a heat sink.

Generally, the printed circuit board is attached to a chassis with the electronic components already in place on the printed circuit board. Then the heat sink is attached over the component to be cooled. Conventionally, four bolts are used at each of the corners of the heat sink base to secure the heat sink onto the printed circuit board.

There may be a number of issues with this approach. For example, tightening the bolts may be a time consuming process. Accessing the bolts past the heat sink fins may be awkward and difficult. The protruding bolts may tend to interfere with the flow of cooling fluid across the heat sink. Other issues may also exist.

Thus, there is a need for better ways to secure heat sinks over components to be cooled on printed circuit boards.

Brief Description of the Drawings

Figure 1 is a side elevational view of one embodiment of the present invention;

Figure 2 is a vertical cross-section taken generally along the line 2-2 in Figure 1;

Figure 3 is a vertical cross-section through a portion of the device, shown in Figure 2, in accordance with one embodiment of the present invention;

Figure 4 is a side elevational view of a sleeve in place on a printed circuit board in accordance with one embodiment of the present invention;

Figure 5 is a perspective view of a heat sink side assembly in accordance with one embodiment of the present invention;

Figure 6 is a cut-away view of the heat sink side assembly, shown in Figure 5, in accordance with one embodiment of the present invention;

Figure 7 is a perspective view of an assembly rod utilized in the heat sink side assembly in accordance with one embodiment of the present invention;

Figure 8 is a perspective view of one embodiment of the present invention being installed on a heat sink;

Figure 9 is a view corresponding to Figure 8 after the retention assembly has partially engaged the heat sink in accordance with one embodiment of the present invention;

Figure 10 is a perspective view showing the securement of the heat sink assembly to a printed circuit board in accordance with one embodiment of the present invention;

Figure 11 is an enlarged perspective view illustrating the securement of the retention assembly to secure the heat sink over an integrated circuit to be cooled in accordance with one embodiment of the present invention;

Figure 12 is a vertical cross-sectional view illustrating the disassembly technique in accordance with one embodiment of the present invention;

Figure 13 is a cross-sectional view corresponding to Figure 12 and illustrating a subsequent step in the disassembly process in accordance with one embodiment of the present invention; and

Figure 14 is a vertical cross-sectional view corresponding to Figure 13 at a subsequent stage of disassembly in accordance with one embodiment of the present invention.

Detailed Description

Referring to Figure 1, a heat sink 14 may be secured to a printed circuit board 12 to produce a circuit board assembly 10. The heat sink 14 may be any type of heat sink, including those which include a plurality of upstanding fins. The heat sink 14 may be secured over an integrated circuit 20, such as a processor, and a socket body 18, secured to the printed circuit board 12. At

corners of the heat sink 14 are provided a heat sink retention element 16.

Referring to Figure 2, the heat sink retention element 16 may include two portions, including a telescoping upper portion 24 and a lower portion 22. The upper portion 24 includes an assembly rod 26 that extends through the upper portion 24, biased by a spring 28. The lower end of the rod 26 includes the rod base 30, which extends transversely to the length of the rod 26.

As shown in Figure 3, the lower portion 22 may include a flanged upper surface 32 arranged to be situated over the printed circuit board 12. A spring-loaded clip 38 secures the lower portion 22 in a locked position on the printed circuit board 12. At the bottom of the cup-shaped lower portion 22 is an upstanding catch 32, having an L-shaped free end 36 to define the catch.

As shown in Figure 4, the spring-loaded clip 38 is angled inwardly as it extends downwardly so that, as its lower portion passes through an opening in the printed circuit board 12, the spring-loaded clip 38 deflects inwardly into the lower portion 22 and then, after passing the printed circuit board 12, springs outwardly. Thus, as shown in Figure 4, the upper end of the clip 38 and the flange 32 lock the lower portion 22 to the printed circuit board 12. This assembly may be tool-less in that all that is needed, in one embodiment, is to simply insert the lower

portion 22 into an appropriate opening in the printed circuit board 12.

Moving to Figure 5, the upper portion 24 may include a sleeve 48 having a threaded region 46 at its upper end. Over the threaded region 46 is a block 44 which may be a section of a circular shape, matching the upper surface of the upper portion 24. The block 44 is secured to the sleeve 48 by a bolt 42. The rod 26, at this stage, extends upwardly, having an operator 40 which extends transversely away from the rod 26 in two opposed directions.

As shown in Figure 6, the rod 26 is attached to the rod base 30, which has an upstanding ring 50 to retain a spring 28 between the base 50 and the upper portion of the sleeve 48. As better shown in Figure 7, the base 30 includes a cut-out region 31 that is useful in the disassembly process, explained later.

The assembly of the heat sink 14 to the retention element 16 is shown in Figure 8. The free end of the rod 26, containing the operator 40, is passed through an aperture 54 in the base 52 of the heat sink 14. Then the threaded region 46 is threaded into the base 52 at the opening 54, as shown in Figure 9.

Next, the upper portion 24 is engaged into the lower portion 22 which has already been secured to the printed circuit board 12 as illustrated in Figure 4. The upper

portion 24 telescopes into the opening defined in the top of the lower portion 22, as shown in Figure 10.

Then, as shown in Figure 11, the upper portion 24 is pushed down into the lower portion 22 using the operator 40 in one embodiment. Eventually, the operator 40 drives the rod 26 so that its base 30 engages and locks in the catch 34 in the lower portion 22, as shown in Figure 2. In particular, the base 30 has downwardly tapering edges in the flange 50, which spread the L-shaped arms 36 of the catch 34, allowing the rod base 30 to pass, and then become releasably locked within, the catch 34.

Thus, the assembly 10 can be secured together without the need for rotating bolts in some embodiments. In addition, a low profile may be achieved that does not interfere with the flow of fluid through the heat sink 14 in some embodiments of the present invention.

The disassembly process, illustrated in Figures 12 through 14, enables the heat sink assembly 10 to be removed from the board 12. To this end, as shown in Figure 12, the bolt 42 is unfastened from the block 44. As a result, the block 44 may be removed. This enables the operator 40 to be rotated 90 degrees, which rotation was otherwise prevented by the imposition of the block 44. Once the operator 40 can be turned, the rod 26 may be turned, causing the base 30 to turn. The rotation of the base 30

frees the base 30 from the overlying catches 36 and allows the rod 40 to be pulled upwardly.

As shown in Figure 13, the base 30 rotates free of the catch 34 due to the rotation of the operator 40. Then, as shown in Figure 14, the rod 26, engaged by the operator 40, can be lifted upwardly. This action compresses the spring 28. At this point, if four elements 16 are provided and operated at the same time, all that is needed is to simply pull the heat sink 14 away from the printed circuit board 12.

While the present invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

What is claimed is: